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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/649,119

08/26/2003

Paul P. Nguyen

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02/23/2005

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EXAMINER

LE, TOAN K

ART UNIT

PAPER NUMBER

2824

DATE MAILED: 02/23/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

CT

Office Action Summary

Application No.

10/649,119

Applicant(s)

NGUYEN ET AL.

Examiner

Toan Le

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-48 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-48 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 26 August 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
 Paper No(s)/Mail Date 5/17/04; 8/26/03.
- 4) ☐ Interview Summary (PTO-413)
 Paper No(s)/Mail Date. ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☒ Other: East search history.

DETAILED ACTION

Information Disclosure Statement

1. This office acknowledge receipt of the following items from the Applicant:

Information Disclosure Statement (IDS) filed on May 17, 2004.

Information Disclosure Statement (IDS) filed on August 26, 2003.
2. Information disclosed and list on PTO 1449 was considered.

Drawings

3. Figure **1B** should be designated by a legend such as --**Prior Art**-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

4. Claims 27 and 37 are objected to because of the following informalities:

In claim 27, lines 2 and 3, the term "**hard including magnetic layer/Ru/hard magnetic layer**" should be -- **including hard magnetic layer/Ru/hard magnetic layer** --.

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In claim 37, line 1: "31" should be -- 36 --.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claims 1-48 are rejected under 35 U.S.C. 102(b) as being anticipated by Albert et al. (US. 6,847,547).

Regarding claims 1 and 12, Albert et al. disclose in figs. 4, a magnetic element capable of storing multiple bits comprising a first ferromagnetic pinned layer (146) having a first pinned layer magnetization being pinned in a first direction (see fig. 4); a first conductive nonmagnetic spacer layer (148 and see col. 13, line 1) residing between a first ferromagnetic free layer (130' and see col. 18, lines 59-60) and the first ferromagnetic pinned layer (see fig. 4); a conductive connecting layer (128') residing between a second ferromagnetic pinned layer (126') and the first ferromagnetic free layer (see fig. 4); a second conductive nonmagnetic spacer layer (124' and see col. 13, line 1) residing between a second ferromagnetic free layer (122' and see col. 18, lines 59-60) and the second ferromagnetic pinned layer (see fig. 4), wherein the first and second

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free layer magnetizations of the first and second ferromagnetic free layers are allowed to change direction due to spin transfer when a write current is passed through the magnetic element (see line 60 of col. 11 to line 5 of col. 12).

Regarding claim 2, Albert et al. disclose the first free layer (130') being written by first and second write currents, the first write current in a first current direction, the second write current in a second current direction; and the second free layer (122') being written by third and fourth write currents, the third write current in a first current direction, the fourth write current in a second current direction, the third write current and the fourth write current being different (see fig. 4 and line 34 of col. 10 to line 31 of col. 11).

Regarding claims 3, Albert et al. disclose in fig. 4, the connecting layer (128') being an antiferromagnetic layer adjacent to the second pinned layer (126') and the first pinned layer (146).

Regarding claim 4, Albert et al. disclose the connecting layer, the first pinned layer, and the second pinned layer form a synthetic antiferromagnet including hard magnetic layer/Ru/hard magnetic layer or hard magnetic layer/Ru/soft magnetic layer (see line 61 of col. 8 to line 23 of col. 9).

Regarding claim 5, Albert et al. disclose in fig. 3, an antiferromagnetic layer (124) adjacent to and between the second pinned layer (126) and the first free layer (130).

Regarding claims 6-9, 15 and 20-21, Albert et al. disclose the first and second free layers, the first and second pinned layers are synthetic layers (see col. 18, lines 55-60).

Regarding claims 10-11, Albert et al. disclose in fig. 4, the first and second nonmagnetic layers (148, 124') are insulating barrier layer allowing charge carries to tunnel between the first, second pinned layers and the first, second free layers, respectively.

Regarding claim 13, Albert et al. disclose in fig. 4, a barrier layer (132') residing between a third pinned layer (134') and the first free layer (130'), the third pinned layer having a third pinned layer magnetization pinned in a third direction.

Regarding claims 14,16, Albert et al. disclose in fig. 4, the first direction is parallel or antiparallel to the third direction.

Regarding claim 17, Albert et al. disclose in fig. 4, a second barrier layer (120') residing between a fourth pinned layer (112') and the second free layer (122'), the fourth pinned layer having a third pinned layer magnetization pinned in a fourth direction.

Regarding claims 18, 19, Albert et al. disclose in fig. 4, the second direction is antiparallel to the third direction, and the first direction is parallel to the third direction.

Regarding claim 22, Albert et al. disclose in fig. 4, the third pinned layer (134') is synthetic.

Regarding claims 23, 24, 26, 28, Albert et al. disclose in fig. 4, a magnetic element capable of storing multiple bits comprising a first dual spin tunnel/valve structure (104') including a first nonmagnetic spacer layer (148) residing between a first pinned layer (146) and a first free layer (130'), a first barrier layer (132') residing between the first free (130') and a second pinned layer (134'); a second dual spin tunnel/valve structure (102') including a second nonmagnetic spacer layer (124') residing between a second free layer (122') and a third pinned layer (126'), a second barrier layer (120') residing between the second free layer (122') and a

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fourth pinned layer (112'); an antiferromagnetic connecting layer (128') for pinning the second pinned layer magnetization and the third pinned layer magnetization or for pinning the second pinned layer magnetization and the fourth pinned layer magnetization, wherein the first and second free layer magnetizations of the first and second ferromagnetic free layers are allowed to change direction due to spin transfer when a write current is passed through the magnetic element (see line 60 of col. 11 to line 5 of col. 12).

Regarding claim 25, Albert et al. disclose the first dual spin tunnel/valve structure (104') being written by first and second write currents, the first write current in a first current direction, the second write current in a second current direction; and the second dual spin tunnel/valve structure (102') being written by third and fourth write currents, the third write current in a first current direction, the fourth write current in a second current direction, the third write current and the fourth write current being different (see fig. 4 and line 34 of col. 10 to line 31 of col. 11).

Regarding claim 27, Albert et al. disclose the connecting layer, the second pinned layer, and the third pinned layer form a synthetic antiferromagnet including hard magnetic layer/Ru/hard magnetic layer or hard magnetic layer/Ru/soft magnetic layer (see line 61 of col. 8 to line 23 of col. 9).

Regarding claim 29, Albert et al. disclose in fig. 6, the connecting layer being a synthetic antiferromagnet hard/Ru/hard layer or soft/Ru/soft layer sandwiches between the second (204) and fourth pinned (208) layers.

Regarding claims 30-35, Albert et al. disclose the first and second free layers, the first and second layers, the third and fourth pinned layers are synthetic layers (see col. 18, lines 55-60).

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Regarding claims 36-48, the apparatus as described above would perform a method for programming a magnetic element capable of storing multiple bits as recited in claims 36-48.

Conclusion

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Huai et al. (US. 6,829,161), Bhattacharyya (US. 6,590,806), Sin et al. (US. 6,418,048) disclose a magnetic element similar to that of Albert et al.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Toan Le whose telephone number is (571) 272-1872. The examiner can normally be reached on M-F (8.00AM - 5.30PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard Elms can be reached on (571) 272-1869. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

TL
February 19, 2005



**ANH PHUNG
PRIMARY EXAMINER**